PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference WO34762	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/IB 2002/002492	International filing date *(day/month/year)* 28.06.2002	Priority date *(day/month/year)*
International Patent Classification (IPC) or national classification and IPC H04L 12/56		
Applicant Nokia Corporation et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 4 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☒ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
27.01.2004	27.09.2004
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Kristoffer Ogebjer/EK Telephone No. +46 8 782 25 00

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB 2002/002492

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-11 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* 1-4 received by this Authority on 17.05.2004
pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-3 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB 2002/002492

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-25	YES
	Claims		NO
Inventive step (IS)	Claims	1-12,16-25	YES
	Claims	13-15	NO
Industrial applicability (IA)	Claims	1-25	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Cited documents:

D1: US, A, 6272522
D2: EP, A, 0782072
D3: US, A, 2001043585
D4: US, A, 5655120
D5: US, A, 2002064160
D6: US, A, 5978844
D7: US, A, 4748558

The object of the invention is to make the load balancing more efficient by introducing a load balancer.

D1 relates to a load balancing system that stores the load state of the different processors. The shared memory 34 contains a program that executes in the background to retrieve the information stored in the routing table 62 and maintains the status of the routing table 62 as changes are made to the configuration. This feature is considered to be an equal feature as the feature of containing information about the connection state (abstract).

D2 discloses a system that obtains information about the load and the connection state from servers.

D3 discloses a system where a ZNK sends a packet to a node based on the link and the load of the node.

D4 relates to a system that distributes the load among processors based the load of the processors.

.../...

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB 2002/002492

Box No. VI Certain documents cited

1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date *(day/month/year)*	Filing date *(day/month/year)*	Priority date (valid claim) *(day/month/year)*
US, A, 2002087694	04/07/2002	29/12/2000	

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure *(day/month/year)*	Date of written disclosure referring to non-written disclosure *(day/month/year)*

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

D5 discloses a method that after the call connection request is received the loads supported by a plurality of packet processors are compared. The call connection is then assigned to the packet processor having a load that is no larger than the load supported by any other of the plurality of packet processors.

D6 relates to a system where forwarding means reports the load of the processors to adjusting means. Based on the load the forwarding processor with least load is selected to process a packet.

D7 relates to a system that contains a global processor that examines the load status indicator contained therein which shows the load status of each of the system processors; selects the processor having the lightest load status; and issues an order to treat the service demand from the requesting terminal to the selected processor having the lightest load.

D1 is considered to be the closest state of the art.

The feature of containing information about the load state of the processors and selecting processor for a packet based on this information is known from what D1 discloses. Even though the connection state is not mentioned per se in D1, the routing table contains information about the connection. From what is stated in D1 and the fact that a processor can handle packets from plural connections in general the invention according to claim 13 is considered obvious for a person skilled in the art. In claim 13 it is not clear that the balancing is based on a per-packet basis irrespective where of the specific connection to which a specific packet belongs.

The invention according to claims 14,15 merely states details known or obvious to a person skilled in the art and the details require no inventive activity to implement in a system according to D1. The invention according to claims 14,15 lacks an inventive step.

The cited documents represent the general state of the art.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

The invention defined in claims 1-12 and 16-25 is not disclosed by any of these documents.
The cited prior art does not give any indication that would lead a person skilled in the art to the claimed method, device and system where the balancing is based on a per-packet basis irrespective where of the specific connection to which a specific packet belongs. Therefore, the claimed invention is not obvious to a person skilled in the art.
Accordingly, the invention defined in claims 1-12 and 16-25 is novel and is considered to involve an inventive step. The invention is industrially applicable.

Enclosure of May 17, 2004

PCT-Patent Application No.: PCT/IB02/02492
Nokia Corporation et al.
Our ref: WO 34762

New claims 1 to 25

---

1. A method for balancing the load of resources in a packet switched connection within a communication system, said system comprising processing units (11; 12) for performing communication, at least one load balancing unit (12; 22) for distributing the load to said processing units (11; 12), and a data storage (14; 24), said method comprising the steps of:

obtaining a current connection state as well as a current load state of said processing units from said data storage (14; 24);

selecting by said load balancing unit (12; 22) a processing unit on a per packet basis irrespective of a specific connection to which a respective packet belongs;

maintaining information about the load state of each processing unit (11; 21) so that said selecting step is performed by selecting a processing unit to serve and process a respective packet based on the load state.

2. A method according to claim 1, wherein said data storage is accessed to by said load balancing unit.

3. A method according to claim 1, wherein said data storage is accessed to by said processing units.

4. A method according to claim 1, wherein said information about the load state is maintained as a Boolean state.

5. A method according to claim 1, wherein a processing unit is selected in a round-robin fashion.

6. A method according to claim 1, wherein a supported service profile for each processing unit is maintained.

7. A method according to claim 6, wherein said supported service profile is used as additional selection criteria.

8. A method according to claim 1, wherein said load balancing unit obtains a load state from each processing unit upon a hardware based mechanism.

9. A method according to claim 1, wherein said load balancing unit obtains a load state from each processing unit upon a packet based mechanism.

10. A method according to claim 9, wherein a load state of a processing unit is inserted into a packet processed by said unit.

11. A method according to claim 9, wherein a packet returned by a processing unit is interpreted as a flag for a free resource.

12. A method according to claim 1, wherein excess traffic is redirected to another load balancing unit, said excess traffic being defined upon the number of active processing units.

13. A device unit for serving and processing packets of a communication connection, comprising:

means adapted to inform a load state of said device to a balancing unit; and

means adapted to obtain a state of said communication connection,

wherein said device unit is adapted to serve and process packets of plural connections.

14. A device unit according to claim 13, wherein said obtaining means is adapted to retrieve said communication connection state from a data storage.

15. A device unit according to claim 13, wherein said obtaining means is adapted to retrieve said communication connection state from a packet being under processing.

16. A device unit for balancing a load of each of multiple processing units performing a packet switched communication connection, comprising:

means for maintaining a load state of each of said processing units; and

means adapted to select a processing unit on the basis of a respective load state on a per packet basis irrespective of a specific connection to which a respective packet belongs.

17. A device according to claim 16, wherein a load state of a processing unit is contained in a table.

18. A device according to claim 16, wherein a load state of a processing unit is expressed as a Boolean value.

19. A device according to claim 16, wherein a load state of a processing unit is expressed as value which corresponds to the percentage of load.

20. A device according to claim 16, wherein said selecting means is adapted such that a processing unit is selected

also on the basis of a parameter indicating the service profile supported by a respective processing unit.

21. A device according to claim 20, wherein said parameter is contained in a table.

22. A device according to claim 16, further comprising means adapted to insert a communication connection state into a packet to be routed.

23. A device according to claim 16, wherein the processing units are comprised of multicore digital signal processing means having a shared data storage for all cores, whereby said device comprises a first level of load balancing for selecting a digital signal processing means and a second level of load balancing for selecting a single core.

24. A device according to claim 16, further comprising means for redirecting excess traffic to another device according to claim 16, wherein said excess traffic is defined upon the number of active processing units.

25. A system adapted to perform a method according to any of the claims 1 to 12.